APPENDIX C.10

ENVIRONMENTAL CONSEQUENCES DATA

TABLE OF CONTENTS

List of Tables

C.10 Environmental Consequences Data

C.10.1 WASTE PROCESSING ALTERNATIVES AND OPTIONS

This section presents a summary of data that were used to discuss environmental consequences in the quantitative sections of Chapter 5. The data are presented for each alternative and option. For the Minimum INEEL Processing Alternative, data have been presented for impacts at both INEEL and the Hanford Site. Five categories of construction data, named in the first column of Table C.10-1, were discussed in Chapter 5 and summarized by discipline below. Eight categories of operations data, named in the first column of Table C.10-2, were discussed in Chapter 5 and are also summarized by discipline below.

Land Use. For the operations phase, the values presented in Table C.10-2 are estimates of the amount of land outside of established facility areas that would be disturbed if a particular waste processing alternative is implemented. Land use impacts are discussed in Section 5.2.1.

Socioeconomics. The values presented are the estimated peak year employment and total earnings for both construction and operational phases for each of the proposed waste processing activities for the period 2000 to 2035. These employment levels are not the result of substantial new job creation but reflect the retraining and reassignment of existing personnel. Waste processing related employment is discussed in Section 5.2.2. The employment levels reported in Section 5.2.2 do not distinguish between jobs that are retained and those that are newly generated. A detailed analysis of socioeconomic impacts is provided in Appendix C.1.

Air Resources. The values presented for the construction phase are for parameters associated with nonradiological airborne emissions from construction activities (i.e., operation of heavy equipment, etc.). The values presented for the operations phase are for parameters associated with both radiological and nonradiological airborne emissions during normal waste processing activities. Radiological parameters are the radiation doses from airborne radionuclide emissions that would be received by (a) a hypothetical person residing at the offsite location of highest predicted dose (called the offsite maximally exposed individual); (b) an INEEL worker who is assumed to spend all of his work time at the onsite area of highest predicted dose (called the noninvolved worker); and (c) the entire population located within 50 miles of INTEC. These doses are calculated using a combination of historical monitored emissions data, projected emissions estimates, atmospheric dispersion modeling using annual average meteorological data measured near INTEC, and exposure and dose modeling as described in alternatives and option.

Appendix C.2. Nonradiological parameters for the operations phase include: (a) maximum ambient air concentration of a criteria air pollutant, expressed in terms of the highest percentage of an applicable ambient air quality standard and allowable increment under Prevention of Significant Deterioration rules; (b) maximum ambient air concentration of carcinogenic and non-carcinogenic toxic air pollutants, expressed as the maximum percentage of any level allowed by State of Idaho regulations; and (c) maximum onsite concentration of toxic air pollutants, expressed as the maximum percentage of any occupational exposure limit. Nonradiological pollutant concentrations were calculated using a combination of historical monitored emissions data, projected emissions estimates, and atmospheric dispersion modeling using the ISC-3 code and hourly meteorological data measured near INTEC, as described in Appendix C.2.

Health and Safety. Health and safety impacts for the construction and operational phases are presented in terms of radiological, nonradiological, and occupational injury impacts. The estimated radiation dose is presented for the onsite (involved and non involved) and offsite maximally-exposed individuals. The estimated radiation dose and related increase in latent cancer fatalities over the entire period of waste processing activities are presented for the collective involved worker population. The dose to the individual involved worker and collective involved worker group is based on expected radiological conditions from prior INEEL exposure data for similar facility operations. The annual offsite maximally-exposed individual, general population, and worker radiological impact data are discussed in Section 5.2.10 for the waste processing options. The nonradiological data is presented in terms of the projected noncarcinogenic and carcinogenic toxic pollutant concentrations at the site boundary for the proposed waste processing options. The pollutant concentrations and their hazard quotients (ratio of expected concentration to the Idaho regulatory standard) are discussed in Section 5.2.10. The projected occupational injury data associated with waste processing options is presented in terms of total lost workdays and total recordable cases that would occur over the entire operations phase of each option. The projected lost workdays and total recordable case rates are based on INEEL historic injury rates multiplied by the predicted employment levels for each option. Further data on lost workdays and total recordable cases for peak employment years are discussed in Section 5.2.10.

Utilities and Energy. The values presented for the construction and operational phases are for water use (potable and non-potable), electricity use, sanitary wastewater, and fossil fuel use. They represent an estimate of the change in annual consumption (water, electricity, and fossil fuels) and generation (sanitary wastewater) that may result from proposed waste processing activities for each alternative and option. The baseline site water use is the annual water consumption for the site for all operations. The maximum percent of baseline site water represents the annual maximum incremental change in water use that would

occur because of the proposed waste processing activities. The baseline site electricity use is the annual power consumption for the site for all operations. The maximum percent of site electricity use represents the annual maximum incremental change in power consumption that would occur because of the proposed waste processing activities. The baseline site sanitary wastewater value represents the annual volume of wastewater generated from total site operations. The maximum percent of baseline site sanitary wastewater represents the annual maximum incremental change in wastewater generation that would occur as a result of the proposed waste processing activities. The maximum percent of site fossil fuel use represents the annual maximum incremental change in fossil fuel use that would occur because of the proposed waste processing activities. Water use, electricity use, sanitary wastewater, and fossil fuel use, and related consequences are discussed in Section 5.2.12.

Waste and Materials. For the construction and operational phases, the generation of mixed low-level, low-level, hazardous, and industrial (nonhazardous and nonradiological) wastes (in cubic meters) along with a total of all wastes generated is provided. The operational periods for the various alternatives and options would begin at different times, ranging from 1999 to 2007, but the period of evaluation ends with the year 2035 in all cases. Correspondingly, the total waste generation values presented here are only for activities through the year 2035. The waste volumes are discussed in Section 5.2.13. It should be noted that the three options under the Separations Alternative in both tables include waste generation from the base case disposal option (i.e., disposal in a new Low-Activity Waste Disposal Facility) for the grouted low-level waste fraction. Section 5.2.13 includes waste generation estimates for other disposal options in addition to the base case.

Traffic and Transportation. For incident free high-level waste transportation under the operations phase, the values in Table C.10–2 represent the total fatalities from shipments of waste for each alternative by truck and rail. Total fatalities are the sum of radiation related latent cancer fatalities for transportation workers and the general population, plus nonradiological fatalities from vehicular emissions. The estimated risks of latent cancer fatalities represent the radiological risk from transportation accidents. The estimated risk of vehicle related traffic fatalities represents the nonradiological risk from traffic accidents. Both quantities are based on the total number of shipments associated with each alternative. These data are an aggregate of the data presented in Section 5.2.9 and Appendix C.5.

Facility Accidents. For accidents under the operational phase, the maximally-exposed individual and collective dose values in the tables are for the accident having the highest consequences to workers or the public. The accidents selected for reporting are not necessarily the same for workers and the general

population. In each category (abnormal event, design basis, and beyond design basis), the accident with the highest consequences was selected, which may be different for workers and the general population. Accident analyses reported in this summary are based on waste processing-related activities only and are found in Section 5.2.14 and in Appendix C.4.

C.10.2 FACILITY DISPOSITION ALTERNATIVES

This section presents a summary of data that were used to discuss facility disposition in the quantitative sections of Section 5.3. The data are presented for new facilities in Table C.10-3 and for existing facilities in Table C.10-4. In Table C.10-3, the data are presented for dispositioning the new facilities that are associated with each of the proposed waste processing options. All new facilities would be dispositioned to clean closure standards at the conclusion of all waste processing activities. Since there are no new facilities under the No Action Alternative, there is no column for No Action in Table C.10-3. Five disposition alternatives are under consideration for the existing facilities. In Table C.10-4, data are presented for each of the proposed disposition alternatives. No descriptions of these alternatives are provided in Section 5.3. Five categories of quantitative data were discussed in Section 5.3, are summarized by discipline below, and presented in Tables C.10-3 and C.10-4. Tables C.10-5 and C.10-6 present the result of the long-term facility disposition fate and transport modeling.

Socioeconomics. The values presented are for the estimated peak year employment and income and are the estimated totals for the life of the dispositioning activity. These employment levels are not the result of substantial new job creation but reflect the retraining and reassignment of existing personnel. Waste processing related employment is discussed in Section 5.3.2. A detailed analysis of socioeconomic impacts is provided in Appendix C.1.

Air Resources. The values presented are for parameters associated with total radiological and nonradiological airborne emissions from normal dispositioning activities. Radiological parameters are the radiation doses from airborne radionuclide emissions that would be received by (a) a hypothetical person residing at the offsite location of highest predicted dose (called the offsite maximally exposed individual); (b) an INEEL worker who is assumed to spend all of his work time at the onsite area of highest predicted dose (called the noninvolved worker); and (c) the entire population located within 80 kilometers (50 miles) of INTEC. These doses are calculated using a combination of historical monitored emissions data, projected emissions estimates, atmospheric dispersion modeling using annual average meteorological data measured near INTEC, and exposure and dose modeling as described in

Table C.10-5. Summary of total lifetime radiation dose and excess carcinogenic risk from exposure to radionuclides according to receptor and facility closure scenario.

Receptor	Facility closure scenario					
	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Lifetime radiation dose to potential receptors (millirem)						
Maximally exposed resident farmer	8.7[a]	13	18	50	21	51
Average resident farmer	4.8	2.7	3.7	10	4.2	10
INEEL worker	5.3	8.9×10^{-11}	9.0×10^{-11}	3.8×10^{-9}	8.9×10^{-11}	9.1×10^{-11}
Construction worker	1.4	1.4	2	5.4	2.2	5.4
Indoor worker	1.4	1.4	2	5.4	2.2	5.4
Unauthorized Intruder[b]	0.29	0.023	2.4×10^{-3}	1.5	0.023	0.023
Uninformed Intruder[c]	0.047	3.8×10^{-3}	7.7×10^{-3}	0.25	3.8×10^{-3}	3.8×10^{-3}
Recreational user	0.22	0.31	0.42	1.2	0.48	1.2
Excess cancer risk (per thousand)						
Maximally exposed resident farmer	4.4×10^{-3}	6.7×10^{-3}	9.2×10^{-3}	0.025	0.01	0.025
Average resident farmer	2.4×10^{-3}	1.4×10^{-3}	1.9×10^{-3}	5.1×10^{-3}	2.1×10^{-3}	5.1×10^{-3}
INEEL worker	2.7×10^{-3}	4.5×10^{-14}	4.5×10^{-14}	1.9×10^{-12}	4.5×10^{-14}	4.5×10^{-14}
Construction worker	6.9×10^{-4}	7.2×10^{-4}	9.8×10^{-4}	2.7×10^{-3}	1.1×10^{-3}	2.7×10^{-3}
Indoor worker	6.8×10^{-4}	7.2×10^{-4}	9.8×10^{-4}	2.7×10^{-3}	1.1×10^{-3}	2.7×10^{-3}
Unauthorized Intruder[a]	1.4×10^{-4}	1.1×10^{-5}	1.2×10^{-6}	7.5×10^{-4}	1.1×10^{-5}	1.1×10^{-5}
Uninformed Intruder[b]	2.4×10^{-5}	1.9×10^{-6}	3.9×10^{-6}	1.3×10^{-4}	1.9×10^{-6}	1.9×10^{-6}
Recreational user	1.1×10^{-4}	1.5×10^{-4}	2.1×10^{-4}	5.8×10^{-4}	2.4×10^{-4}	5.8×10^{-4}

a. An air pathway dose of 170 millirem is calculated based on a maximally exposed individual dose due to failure of a single bin set.
b. Time frame for receptor exposure is during period of institutional control (before 2095).
c. Time frame for receptor exposure is distant future.

Appendix C.2. Nonradiological parameters include: (a) maximum ambient air concentration of a criteria air pollutant, expressed in terms of the highest percentage of an applicable ambient air quality standard and allowable increment under Prevention of Significant Deterioration rules; (b) maximum ambient air concentration of carcinogenic and non-carcinogenic toxic air pollutants, expressed as the maximum percentage of health-based reference levels designated (for new facilities) by State of Idaho regulations; and (c) maximum onsite concentration of toxic air pollutants, expressed as the maximum percentage of any occupational exposure limit. Nonradiological pollutant concentrations were calculated using a combination of historical monitored emissions data, projected emissions estimates, and atmospheric dispersion modeling using the ISC-3 code and hourly meteorological data measured near INTEC, as described in Appendix C.2.

Table C.10-6. Summary of estimated noncarcinogenic health hazard quotients from exposure to nonradiological contaminants according to receptor and facility closure scenario.

	Facility closure scenario					
Receptor	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Health hazard quotient due to cadmium intake						
Maximally exposed resident farmer	4.3×10^{-7}	6.5×10^{-8}	4.6×10^{-7}	4.8×10^{-7}	1.5×10^{-5}	1.6×10^{-5}
Average resident farmer	6.7×10^{-8}	1.0×10^{-8}	7.1×10^{-8}	7.5×10^{-8}	2.3×10^{-6}	2.5×10^{-6}
INEEL Construction worker	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Indoor worker	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Recreational user	3.7×10^{-9}	1.2×10^{-9}	8.7×10^{-9}	9.1×10^{-9}	2.8×10^{-7}	3.1×10^{-7}
Health hazard quotient due to fluoride intake						
Maximally exposed resident farmer	0.08	5.2×10^{-4}	0.12	0.27	1.4	1.4
Average resident farmer	0.04	2.6×10^{-4}	0.058	0.13	0.69	0.71
INEEL Construction worker	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Indoor worker	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Recreational user	1.8×10^{-3}	1.2×10^{-5}	2.6×10^{-3}	4.1×10^{-3}	0.032	0.032
Health hazard quotient due to nitrate intake						
Maximally exposed resident farmer	6.5×10^{-3}	3.0×10^{-5}	1.1×10^{-4}	1.1×10^{-4}	3.0×10^{-5}	3.0×10^{-5}
Average resident farmer	2.9×10^{-3}	1.3×10^{-5}	5.0×10^{-5}	5.0×10^{-5}	1.3×10^{-5}	1.3×10^{-5}
INEEL Construction worker	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Indoor worker	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Recreational user	8.4×10^{-5}	3.9×10^{-7}	1.5×10^{-6}	1.5×10^{-6}	3.9×10^{-7}	3.9×10^{-7}

Health and Safety. Health and safety impacts are presented in terms of total radiological and occupational injury impacts for the entire period of the dispositioning activities. The estimated increase in latent cancer fatalities is presented for the collective involved worker population. The dose to the collective involved worker group is based on expected radiological conditions from prior INEEL exposure data for similar facility operations. The projected occupational injury data associated with waste processing options is presented in terms of total lost workdays and total recordable cases that would occur over the entire operations phase of each option. The projected lost workdays and total recordable case rates are based on INEEL historic injury rates multiplied by the predicted employment levels for dispositioning activities following each waste processing option and for each disposition alternative for the existing facilities. Further data on lost workdays and total recordable cases are discussed in Section 5.3.8.

Utilities and Energy. The values presented are for water use (potable and non-potable), electricity use, sanitary wastewater, and fossil fuel use. They represent the utility and energy requirements for dispositioning (clean closing) new facilities built to support the various waste processing alternatives and

dispositioning existing facilities, depending on the facility disposition alternative selected. Water use, electricity use, sanitary wastewater, and fossil fuel use and related consequences are discussed in Section 5.2.12.

Waste and Materials. The data presented represent the total generation of mixed low-level, low-level, hazardous, and industrial nonhazardous and nonradiological wastes (in cubic meters) from the dispositioning activities over the entire dispositioning period. The waste volumes are discussed in Section 5.3.11.